AFOSR Special Announcement

BAA No. AFOSR 2001-4

AFOSR 2001 Themes - MEANS

I. INTRODUCTION

The Air Force Office of Scientific Research (AFOSR) announces a fiscal year 2001 competition for research in a area known as Theme 2001 - Materials Engineering for Affordable New Systems (MEANS).

II. PROGRAM GOALS

MATERIALS ENGINEERING FOR AFFORDABLE NEW SYSTEMS (MEANS)

Background: Over the last twenty years, developments in computer-aided design and manufacturing have dramatically reduced the product cycle time from initial concept to finished component. Unfortunately, progress in the development of materials and processes that optimize the performance and life expectancy of components has not kept pace with these developments. Currently, the interface between engineering design and materials science and engineering consists of a collection of empirically developed and verified material property databases obtained by *ad hoc* experiments. Recent developments in materials modeling and computation hold the promise of providing a critical link in the concurrent design of materials and processes. Development of computer simulation techniques that describe material properties in various regimes of length and time from nanometers and picoseconds through centimeters and years can reduce the domain of experiments that must be performed to qualify materials for use. The current challenge resides in the fusion of materials modeling and computational tools into a continuous spectrum that begins with *ab initio* principles and, complemented by selective experimentation, provides a seamless interface with databases required for current engineering design applications. Techniques for uncertainty modeling, lifetime assessment and prediction must accompany this development as an integral part of the overall design strategy. Now is the time for an interdisciplinary effort to exploit present computational capabilities by developing physics-based modeling techniques that are capable of closing the gaps between the regimes that separate both the time and size scale domains and selectively using experiments to verify the accuracy of predictions.

This program envisions the development of generic techniques for coupling *ab initio* calculations of thermodynamic, structural and kinetic properties of materials with models of microstructural entities that determine macroscopic behavior, concepts that link microscale and mesoscale models with continuum descriptions of material behavior and techniques that employ these descriptions to calculate properties of materials in a format that can be integrated into engineering design software. Uncertainty modeling leading to lifetime prediction and assessment models will accompany this development. Modeling at all levels will be accompanied by critical experiments designed to verify analytical predictions and techniques for estimating the reliability and scatter of the computed properties. Emphasis throughout will be on the reduction of empiricism and *ad hoc* assumptions and the compatibility of each model with those for adjacent length and time scales. Principal goals of this effort are to develop improved structural materials, design methodologies and manufacturing processes by combining experimental and modeling tools from the atomic scale, through the meso scale, and up to the system scale while simultaneously controlling or predicting material reliability issues related to performance.

Objective: To develop a global design methodology employing materials modeling and strategic experimentation that spans length and time scales from individual atoms to engineering structures, emphasizing compatibility between models at adjacent scales, interoperability with existing design software, lifetime prediction and uncertainty modeling.

Research Concentration Areas: The emphasis of this program is on materials used for structural applications, including multiphase alloys and ceramics as well as composites based on metallic, ceramic and polymeric materials. The program will accommodate two research modalities, each of which will include experimental and analytical components. Mode I consists of the coordination by AFOSR program managers of individual projects in materials science and engineering, physics, chemistry, mathematics and engineering design to form collaborative clusters that address all or part of the program spectrum. These clusters will be formed from single topic projects submitted in response to this solicitation. Single topic projects including one or more investigators can address, *but are not limited to*, such topics as: quantitative determination of microstructural features in a form suitable for inclusion in constitutive equations, constitutive equation development that incorporates microstructural features, process models designed to produce specific microstructures and material behavior, calculations of atomic arrangements around defects, models of material behavior that span several length and time scales, life prediction models for polymer matrix composites (PMC) based on degradation mechanisms rather than empirical accelerated aging data, models to predict resin properties of PMC based on formulation and chemical compositions, models that describe the prepreging operation, processing models for cure kinetics, resin flow and consolidation of PMC, micro-mechanical models describing the ply properties, lay-up sequence, fiber-matrix interface in PMC, systems optimization, computational methods and computationally assisted design of structural ceramic materials.

Mode II consists of vertically integrated investigations that address all or a substantial part of the program spectrum performed by interdisciplinary multi-investigator teams that include participation from industry. Projects in this Mode are encouraged to employ advanced design philosophies such as decision based design. These efforts will culminate in the development of design software tools that can be employed to produce a prototype component representative of one used in an Air Force system. The following examples illustrate, *but do not prescribe*, goals of Mode II projects: development of a strategy for integrating models of PMC that describe resin and fiber properties, processibility prediction, quality control, component performance and life cycle cost and prediction; a virtual design and manufacturing system complemented by an intelligent material selection system; design of processes for producing ceramic materials and components for application at ultra high temperatures; design of an aircraft gas turbine engine component optimized for performance, reliability, and affordability. The Air Force reserves the right to concentrate all program support into one of these modalities depending on the response to this solicitation.

Impact: Research is required to develop and verify tools that will minimize expensive and redundant experimentation for the generation of databases and will permit parallel, global design to replace serial design throughout the product development cycle. Projects in this program will provide basic knowledge necessary for further development and implementation of techniques currently being developed on the Accelerated Insertion of Materials (AIM) program sponsored by DARPA. Implementation of these techniques will permit more rapid development and insertion of appropriate materials into the manufacture of structures and equipment. Results will be more reliable and affordable materials required for accomplishment of the Air Force mission.

MEANS Theme Program Managers: Dr. Craig S. Hartley (703) 696-8523, craig.hartley@afosr.af.mil (**Theme Coordinator** and Metallic Materials), Dr. Charles Y.-C. Lee, (703) 696-7779, charles.lee@afosr.af.mil (Organic Matrix Composites), Dr. Joan Fuller (703)696-7236, joan.fuller@afosr.af.mil (Ceramics and Non-metallic Materials), Dr. Thomas Hahn (703) 696-8483, thomas.hahn@afosr.af.mil, (Mechanics of Materials and Devices),

Dr. Neal Glassman (703) 696-8431, neal.glassman@afosr.af.mil, (Optimization and Discrete Mathematics), and Dr. Arje Nachman (703) 696-8427, arje.nachman@afosr.af.mil, (Physical Mathematics and Applied Analysis)

III. CONDITIONS

To receive consideration for funding this fiscal year, proposals should be received at AFOSR by 3:00 PM EST, 1 June 2001. Proposals received after that date may be considered for funding at a later time. Questions regarding technical aspects of the theme can be directed to any of the participating program managers. Proposals must be submitted to the Theme Coordinator identified in Part II at the following address:

Air Force Office of Scientific Research
801 North Randolph Street Rm 732
Arlington VA 22203-1977

Target award date for awards is 1 September 2001. The Government reserves the right to select for award, all, some or none of the proposals received.

Cost sharing is encouraged but not required.

Proposals may not be submitted by fax or e-mail; any so sent will be disregarded.

IV. PROPOSALS

A. Submitting proposals

Proposals should be no longer than 30 pages (excluding cover and budget sheets and *c.v.* of investigators). An original and five (5) copies of the proposal are required. Proposals may also be submitted by electronic media (floppy disk, zip disk or CD-ROM in MS Word or Portable Document File (PDF) format). Sections IV B & C contain instructions for submitting proposals. Proposals will be evaluated using the criteria set forth in Section IV D.

B. Format and Technical Content Proposals

Each proposal should be typed single sided in 10 or 12-point, double-spaced, on 8 1/2 X 11 inch white paper, bound or stapled to keep documents intact and allow convenient handling. Attachments, such as institutional brochures or reprints, will not be considered in the evaluation or selection process.

The proposed objective should be the performance of research in support of the program goals delineated in Section II. For this reason, proposals must adequately describe the proposed research (including current state-of-the-art, recent contributions of the proposer, intended technical approach and expected results) objectives, approach and expected outcomes. This information will allow evaluation of prospective research quality and relevance.

1. Cover Page. To be eligible for consideration, each copy of the proposal should bear as a cover page provided in Appendix A (or a photocopy thereof). The original proposal and each copy must include these pages.

2. Abstract. The abstract of the proposal should be no more than one page long.

3. Text. The technical portion of the proposal must contain the following:

a. A conceptual outline of research goals and proposed scientific approaches identifying novel or innovative features.

b. Describe in detail the research to be undertaken. State the objectives, approach and relationship to the current state of knowledge. Include an appropriate bibliography and list of literature citations. Summarize the expected research results and significance as well as the expected contribution toward meeting the objectives of the program outlined in Section II.

c. Estimate the time that each principal investigator and other senior professional personnel will devote to the research. For research teams describe the task breakdown and research responsibilities of each constituent unit.

d. Describe facilities available for performing the proposed research and any additional facilities or equipment proposed for acquisition.

4. Curriculum Vitae. Furnish brief vitae for key research personnel, including senior investigators. Provide biographical sketches and list relevant publications. *Vita* should be limited to two pages for each investigator. List names and titles of other scientific or technical personnel who will be directly associated with the project.

C. Financial Content of Proposal

The financial portion of the proposal must contain a cost estimate for the proposed effort including a description of cost sharing arrangements, if any. It is anticipated that the awards will have a performance period of thirty-six months. For evaluation purposes budgets should be for each twelve-month period. Assume a 1September 2001 effective date. AFOSR will make payment to educational and non-profit recipients based upon a predetermined payment schedule. Payments will normally be made quarterly in advance of performance, based upon a spending profile that must be provided as part of the proposal. Payments should be limited to the amounts needed to conduct research during each respective period. Educational and non-profit organizations shall submit a spending profile with their cost proposal. For further details, proposers should refer to the "Proposer's Guide to AFOSR Research Programs" (see Section V J for availability).

D. Evaluation and Selection of Proposals

Proposals will be evaluated under the following two primary criteria, of equal importance, as follows:

1. The scientific and technical merits of the proposed research in the context of the objectives of the theme.

2. The potential contributions of the proposed research to the mission of the USAF.

Other evaluation criteria used in the technical reviews, which are of lesser importance than the primary criteria and of equal importance to each other, are:

1. The likelihood of the proposed effort to develop new research capabilities and broaden the research base in support of US national defense.

2. Qualifications, capabilities and related experience of key personnel, facilities, or techniques or a combination of these factors that is integral to achieving USAF objectives.

3. The proposer's and associated personnel's record of past performance.

4. The realism and reasonableness of proposed costs.

No further evaluation criteria will be used in source selection. The technical and cost information will be analyzed simultaneously during the evaluation process. The US Government does not guarantee an award in each topic area. Further, be advised that, because funds are limited, otherwise meritorious proposals may not be funded. Therefore, it is important that proposals show strength in as many of the evaluation areas as practicable for maximum competitiveness.

E. Awards

Subject to the availability of funds and selection of adequate proposals, AFOSR will award grants, cooperative agreements or contracts likely not to exceed $200K per year for Mode I awards and $500K per year for Mode II awards. It is anticipated that the awards will have a performance period of thirty-six months. Negotiations may reduce funding of the awards to an amount lower than that proposed.

V. ADDITIONAL INFORMATION

A. The cost of proposal preparation in response to this Announcement is not considered an allowable direct charge to any resulting award. Such cost is, however, an allowable expense to the normal bid and proposal indirect cost specified in FAR 31.205-18, or OMB Circular A-21, Cost Principles for Educational Institutions or OMB Circular A-122, Cost Principles for Nonprofit Organizations.

B. Every effort will be made to protect the confidentiality of the proposal and any evaluations. The proposer must mark the proposal with a protective legend in accordance with FAR part 15.6, Use and Disclosure of Data, if protection is desired for proprietary or confidential information.

C. Proposals should briefly address whether the intended research will result in environmental impacts outside the laboratory, and how the proposer will ensure compliance with environmental statutes and regulations.

D. Technology sharing and transfer is encouraged; in this respect, AFOSR welcomes proposals that envision university-industry cooperation. Non-industry proposers are encouraged to specify in their proposals their interactions with industry and the Air Force Research Laboratory’s Technical Directorates, including specific points of contact. Cooperation with or use of facilities of the Air Force Research Laboratory is also encouraged. Personnel interaction (e.g., university faculty or students performing research at industry or Air Force Research Laboratory sites; industry or Air Force staff working in university laboratories) is viewed as highly desirable. Further information regarding the Air Force Research Laboratory may be viewed at http://www.afrl.af.mil/.

E. Only contracting or grants officers are legally authorized to bind the government.

F. Proposals are encouraged from Historically Black Colleges and Universities (as determined by the Secretary of Education to meet requirements of 34 CFR Section 608.2) and from Minority Institutions (as defined by 10 U.S.C. 2323 (a) (1) (C)), either individually or as members of proposing consortia. However, no funds are specifically allocated for HBCU/MI participation.

G. Unnecessarily elaborate brochures or presentations beyond those sufficient to present a complete and effective proposal are not desired.

H. This document will guide proposers and facilitate their preparation of research proposals in AFOSR BAA 2001-4, AFOSR 2001 Themes - MEANS. It, and other AFOSR documents, are available on the AFOSR website at http://www.afosr.af.mil or http://afosr.sciencewise.com/.

H. Central Contractor Registration

1. Definitions.

(a) Central Contractor Registration (CCR) database means the primary DoD repository for information required for the conduct of business with DoD.

(b) Data Universal Numbering System (DUNS) number means the 9-digit number assigned by Dun and Bradstreet Information Services to identify unique business entities.

(c) Data Universal Numbering System +4 (DUNS+4) number means the DUNS number assigned by Dun and Bradstreet plus a 4-digit suffix that may be assigned by a parent (controlling) business concern. This 4-digit suffix may be assigned at the discretion of the parent business concern for such purposes as identifying subunits or affiliates of the parent business concern.

(d) Registered in the CCR database means that all mandatory information, including the DUNS number or the DUNS+4 number, if applicable, and the corresponding Commercial and Government Entity (CAGE) code, is in the CCR database; the DUNS number and the CAGE code have been validated; and all edits have been successfully completed.

2. (a) By submission of an offer, the offeror acknowledges the requirement that a prospective awardee must be registered in the CCR database prior to award, during performance, and through final payment of any award resulting from this solicitation, except for awards to foreign vendors for work to be performed outside the United States.

(b) The offeror shall provide its DUNS or, if applicable, its DUNS+4 number with its offer, which will be used by the contracting or grants officer to verify that the offeror is registered in the CCR database.

(c) Lack of registration in the CCR database will make an offeror ineligible for award.

(d) DoD has established a goal of registering an applicant in the CCR database within 48 hours after receipt of a complete and accurate application via the Internet. However, registration of an applicant submitting an application through a method other than the Internet may take up to 30 days. Therefore, offerors that are not registered should consider applying for registration immediately upon receipt of this solicitation.

3. The offeror is responsible for the accuracy and completeness of the data within the CCR, and for any liability resulting from the Government's reliance on inaccurate or incomplete data. To remain registered in the CCR database after the initial registration, the offeror is required to confirm on an annual basis that its information in the CCR database is accurate and complete.

4. Offerors may obtain information on registration and annual confirmation requirements by calling 1-888-227-2423, or via the Internet at www.ccr2000.com.

L. Responses should reference Broad Agency Announcement AFOSR 2001-4 and Theme - MEANS.

COVER PAGE FOR PROPOSAL

SUBMIT COPIES OF PROPOSAL TO:	For Consideration by AFOSR Organization Unit(s)	For AFOSR Use Only
AFOSR 801 North Randolph Street Room 732 Arlington VA 22203-1977	(Indicate the most specific unit known, i.e. program, division, etc.) ☐ Aerospace & Materials Sciences ☐ Mathematical & Space Sciences ☐ Physics & Electronics ☐ Chemistry & Life Sciences ☐ Other (Specify)	**AFOSR Proposal Number** Date Received / Number of Copies / Division Assigned

Theme Area	Data Universal Numbering System Number (DUNS)	Is This Proposal Being Submitted to Another Federal Agency?
AFOSR BAA 2001-4, Theme - MEANS		YES ☐ NO ☐ If YES, List the Agency or Agencies.

Name of Organization to Which Award Should be Made:	Administrative Address of Organization, Including Zip Code:
Institutional Code (If known)	

Is Submitting Organization: ☐ Large Business ☐ Small Business ☐ Disadvantaged Business ☐ Woman-Owned Business

☐ Educational Institution ☐ Historically Black College or University (HBCU) ☐ Minority Institution (MI) ☐ Other Non-Profit

Branch/Campus/Other Component (Where work is performed, if different)	Institutional Code (If known)

Title of Proposed Project	Type of Award Requested:
	☐ GRANT ☐ NEW ☐ CONTRACT ☐ RENEWAL ☐ AGREEMENT ☐ Other (Specify)

Requested Amount	Proposed Duration (1-60 months)	Requested Start Date	Proposal Valid Unit:
$	months		(minimum of 6 months)

Check Appropriate Box(es) If This Proposal Includes Any of the Items Listed Below:

☐ Vertebrate Animals ☐ National Environmental Policy Act ☐ Proprietary and Privileged Information
☐ Human Subjects ☐ Historical Places ☐ Group Proposals

PI/PD Department	PI/PD Postal Address

Typed Names & Signatures	Telephone Number	Facsimile Number	Electronic Mail
PI/PD			
Co-PI/PD			
Administrative Representative Authorized to Conduct Negotiations:			
Primary:	( ) -	( ) -	
Alternate:	( ) -	( ) -	

CERTIFICATIONS: (Not applicable to Contracts) By signing and submitting this proposal, the proposer is providing the certification at Appendix A to 32 CFR Part 25 regarding debarment, suspension, and other matters; the certification at Appendix C to 32 CFR Part 25 regarding drug-free workplace; and the certification at Appendix A to 32 CFR Part 28 regarding lobbying.

Authorized Representative Title:	Date Signed:
Typed Name:	Signature: